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IMPROVED SEED WHEAT FOR NORTH CAROLINA

Pedigreed Leap's Prolific, No. 12 Pedigreed Leap's Prolific, No. 32

N. C. State College of Agriculture and Engineering
N. C. State Department of Agriculture
N. C. Agricultural Experiment Station, and
U. S. Department of Agriculture, Cooperating

Agricultural Extension Service

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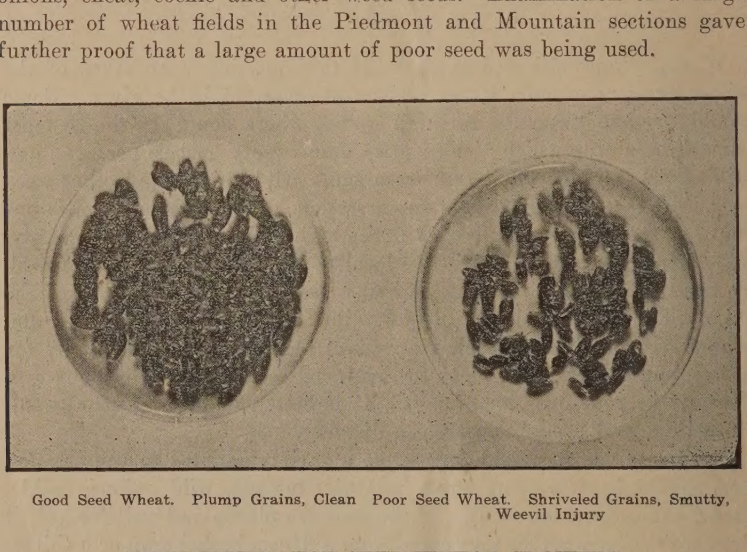
What is improved seed wheat? If this question were asked of the wheat growers of our State, various answers would be given. Some would say that it must be northern grown, others would say that it must come from a crop which yielded more than twenty bushels per acre, and still others would want it free from smut, wild onions, and other weed seed. In fact, the best wheat for a section, community or farm is one that has been chosen on account of its high yield and superior quality, and then further improved in the locality by selecting seed in the field. Secure the best seed that can be had in your locality, from one of the standard varieties, such as Leap's Prolific, Purple Straw, Fulcaster, and others. Before harvest each year, select seed from the best plants for a seed patch. The best place to save good seed wheat is on your own farm or in your own community. It is better adapted to your conditions than seed brought in from a distance.

Good seed wheat should come from a variety adapted to your section and should be free from smut, weather damage, wild onions, cockle, cheat, and other weed seeds. If the seed are plump and well formed, it does not matter whether they came from a fifteen-bushel crop or a thirty-bushel crop. The fertility of the soil cannot change the blood of a productive strain of wheat.

NEED FOR IMPROVED SEED WHEAT

According to information gathered by the North Carolina Bureau of Crop Estimates our average yield of wheat during the past three years has been 7.5 bushels per acre. During the past ten years, the average yield has been approximately 9 bushels. Reports from the ten-year period previous to 1917 give our average yield at approximately 12 bushels per acre. When one considers the yields from individual farms where the crop is properly handled these averages seem very small. Our low yields are due to poor soils, lack of preparation, late planting, unfavorable weather conditions in the spring, and to the use of inferior seed. Judging from the study of varieties of wheat on the Central and Branch Station farms the variety and quality of seed planted has a great deal to do with the final yield. During the past fifteen years, the

North Carolina Experiment Station and State Department of Agriculture have tested a large number of wheats from different sources. In general, the seed wheat secured from local growers and seedsmen has been poor in quality. Much of it has been damaged by wet weather, most of it was badly mixed with smooth and bearded varieties, some of it contained considerable smut, and not a few samples contained wild onions, cheat, cockle and other weed seeds. Examination of a large number of wheat fields in the Piedmont and Mountain sections gave further proof that a large amount of poor seed was being used.



Good Seed Wheat. Plump Grains, Clean Poor Seed Wheat. Shriveled Grains, Smutty, Weevil Injury

OPPORTUNITY FOR SEED-WHEAT GROWERS

Each year North Carolina requires approximately 1,478,000 bushels of seed wheat, and each fall brings a great demand for good seed wheat. In order to meet this demand, seed wheat is brought in from further north by growers and millers, some of it is obtained from local seedsmen and a portion from local growers. The seed as a whole is usually of poor quality. For this reason there is a splendid opportunity for North Carolina growers who will select good wheat for seed purposes. Judging from the large number of inquiries for good seed wheat that come to the Experiment Station and Department of Agriculture, our wheat growers are willing to pay a good price for well-bred seed wheat that has been carefully handled. In fact, our growers are paying high prices for the quality of seed bought from growers and seedsmen of other States. The increased yield alone, due to saving good home-grown seed, would pay handsomely for the time and equipment used in the improvement. We must realize that the saving of good seed on the farm is just as important a part of successful agriculture as is the intelligent

use of fertilizer and cultivation. No amount of fertilizer and culture can make a productive strain of an unproductive one.

HOME-GROWN SEED ARE BEST

Field crops of any kind become better adapted to the locality in which they are grown. When good seed is saved each year from the plants that yield best, the variety or strain becomes better adapted to the farm and locality.

It is customary among some wheat growers of the State to secure new seed from further north every few years. Some of these growers believe that wheat deteriorates or "runs out" when grown in the same locality year after year. Some even believe that a portion of the wheat turns to cheat. The seed from further north is said to yield better and to be hardier than the home-grown seed when planted here. Under some conditions this may be true. If good, clean, plump northern-grown seed wheat is to be compared with poorly handled home-grown seed wheat that has become badly infested with smut and weeds, the northern-grown seed would no doubt yield better. North Carolina seed wheat that has been properly handled will outyield northern-grown wheat.

One reason that is usually given for securing seed wheat from further north is the fact that it has been exposed to more severe winter conditions and is supposed to be hardier. As a matter of fact, the low temperature of Maryland and Pennsylvania are not as severe on winter wheat as that of Piedmont, North Carolina. In Maryland and Pennsylvania the crop is usually protected by snow, while our Piedmont section is usually unprotected, and is exposed to more changeable weather. It is not the low temperature alone that kills, but the sudden cold spell following a week or ten days of mild or warm weather. This is particularly true when there is considerable moisture in the ground. This damage cannot be remedied by bringing in seed from further north. In fact, it will not be remedied until we select strains of wheat that are adapted to our local conditions.

DETERIORATION OR "RUNNING OUT" OF SEED WHEAT

The condition known as "running out" of seed wheat is usually due to poor care of the seed. Too often our wheat fields are infested with smut, wild onions, cheat, cockle, and other weeds. Wheat containing such mixtures is unfit for seed purposes. Wheat that is damaged in the field, stored wet, or stored in damp bins will soon become unfit for seed. Such conditions would injure wheat grown in any section.

HOME-GROWN AND NORTHERN-GROWN SEED WHEAT COMPARED

In order to secure information on this point, the Experiment Station and the State Department of Agriculture have compared the yields from home-grown and northern-grown seed wheat of the same varieties. Sev-

eral varieties have been compared, and in each case the home-grown seed was compared with the same variety of northern-grown seed. The comparisons were made at the Mountain Branch Station, near Asheville, and at the Piedmont Branch Station, near Statesville.

A Good Stand of Vigorous, Uniform Wheat Secured by the Use of Good Home-grown Seed

RESULTS AT THE MOUNTAIN STATION

The comparisons of home-grown and northern-grown seed wheat at the Mountain Branch Station were made during three successive years. In thirteen comparisons during three years, the home-grown seed produced at the rate of 16.5 bushels per acre while the northern-grown seed produced 12.72 bushels per acre, or 3.78 bushels per acre less than the home-grown seed.

	Bus. per Acre
Yield from home-grown seed, average for three years	16.5
Yield from northern-grown seed, average for three years	12.72
Increase due to the use of home-grown seed	3.78

RESULTS AT THE PIEDMONT BRANCH STATION

Similar results were secured at the Piedmont Branch Station. During three years, twenty-three comparisons were made between home-grown and northern-grown seed of the same varieties. In these tests the home-grown seed produced at the rate of 16.01 bushels per acre, while the northern-grown seed produced 15.26 bushels. This gives an average of three pecks per acre in favor of the home-grown seed. The test of

one year contained 13 comparisons in which the home-grown seed averaged 1.3 bushels per acre more than those grown further north. The best variety of wheat for a section is one that has been chosen on account of its high yield and quality, and then further improved in the locality by selecting seed from the best plants. One can easily select sufficient good seed from a field to plant a seed patch. A small seed patch could be kept free from wild onions and mixtures of other grains. By this method one could be sure of producing the best seed for his section.

The high price of wheat is likely to result in a shortage of home-grown seed for planting this fall. This may be avoided by saving the best seed now. Growers who have good seed should save the best for planting this fall. Seedsmen of the State who have not yet collected their supply should use every effort to secure the best North Carolina-grown seed. Millers who have good seed wheat grown in the State may benefit themselves and the growers of their community by saving the best for seed.

HOW CAN I IMPROVE MY WHEAT?

First, be sure that the variety you have is best adapted to your section. Conduct a variety test, it will not take a great deal of time and expense. Your county agent and the Division of Agronomy will help you if you apply to them. You may have gotten impressions of a certain variety grown one year, but there was no other variety grown under the same conditions to compare with it. We may have impressions from what some one has told us, but let's forget them for the present and make a test of our own. It is commonly said that the bearded wheats are more resistant to cold and drought than the smooth wheat. This has not been the case in our tests of a large number of bearded and smooth varieties at the Piedmont Branch Station, near Statesville. In fact, during a ten-year period the smooth wheats have yielded slightly more than the bearded wheats grown under the same conditions. As a rule the smooth wheats are earlier than the bearded wheats. For this reason they are more likely to escape damage from the dry hot weather in the spring. As most of us know this period has been very disastrous to our wheat during the past three years. Some have objected to the smooth wheats because they have short straw. It is true that the early wheats have shorter straw, but after all, yields of wheat and not yield of straw is what one is after. If the straw is too short to handle, the trouble is usually due to low fertility, poor preparation, or late planting. It has been claimed that the bearded wheats are more resistant to rust than the smooth varieties. In our studies of wheat, this has not been found true. Rust is usually more severe on all wheats during the late milk and early dough stage of maturity. The plants are apparently less resistant at this time. If one compares a smooth wheat in the dough stage with a bearded wheat in the early milk stage a greater amount of

rust will be found on the early variety. This is undoubtedly the way this impression has been gained.

In regard to drought resistance, it might be said that any variety of wheat planted in shallow soil, poor in organic matter, will suffer from drought every spring. Other conditions being equal, the later bearded varieties would mature during warmer and dryer weather than the earlier smooth varieties. This would expose the later varieties to greater heat and drought at a very critical time of their development. In limited areas of a few localities of the State, where moisture and soil fertility are not lacking in the spring, the later varieties may do better for it is true of most of our crops that the varieties that use the longer period for growth and maturity usually yield better than those requiring a shorter period.

With these explanations in mind, let's forget impressions that are not based on careful experiments, and select one of the standard early wheats, such as Leap's Prolic, Purple Straw, and Fultz for improvement or make a variety test that will include the best strains of Leap's Prolific, Purple Straw, Fulcaster, Deitz Mediterranean, Fultz, Millers' Choice, and others. Be sure to include the Station selections of Leap's Prolific, Nos. 12 and 32, in the test. (See discussion of these two strains on page 11.)

Having decided upon the variety, secure the best seed of that variety from a breeder or grower who has taken care to keep it pure.

SAVE GOOD SEED IN THE FIELD

Most of us agree that selected and carefully handled seed are worth while, and that they should be used for planting if they can be gotten conveniently; but only those who have carefully compared good and poor seed under field conditions can really appreciate their importance. One will often hear a grower say, "I tried some improved seed over there and it didn't yield as much as my old seed planted in the bottom, or on some other part of the farm." If one questions closely, it will be found that the two lots of seed were planted on different soils, and at different times, and that no careful comparison was made.

If insects or disease came and destroyed 20 to 50 per cent of our crop, it would be noticed and steps would be taken to stop it. The use of poor seed wheat is reducing our possible yields annually from 20 to 50 per cent, and we are doing nothing to stop it.

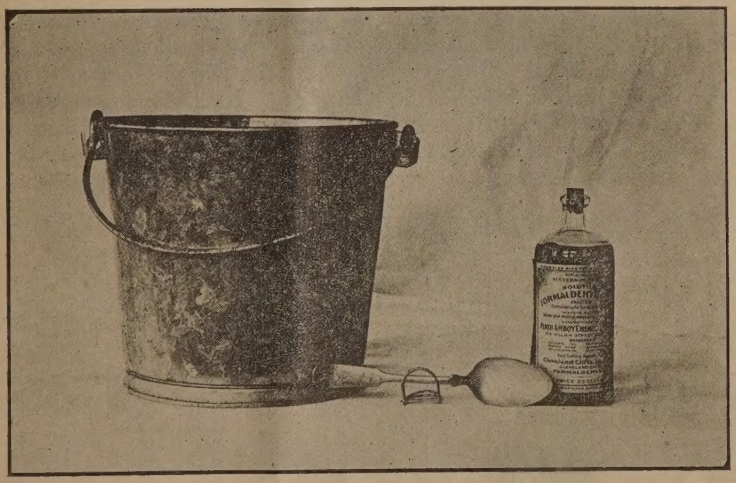
Begin this fall by getting the best seed wheat in your community or section. Plant it on good land and select good heads from the plants that tiller and fill well next spring. A good wheat plant should tiller well, and should bear a good number of well filled heads free from smut. The straw should be medium in length and strong enough to support the heads. Save enough seed by hand each year to plant a half to an acre seed patch. The seed harvested from the seed patch will furnish

excellent seed wheat for the general crop. After the first year, seed for planting the seed patch may be saved from the seed patch of the previous year. In this way the seed wheat can be kept free from weed seed and smut.

If the seed patch fails for one year, hold on to the seed that are produced, don't discard the whole thing because of one crop failure. The failure was not due to poor seed, and if poor seed had been used it might have been worse. Better save seed of good blood from a ten-bushel crop than seed of questionable breeding from a forty-bushel crop. If the seed patch becomes foul with weeds, save out as much as possible by hand and clean the remainder with a good seed cleaner.

TREAT IT FOR SMUT

All seed wheat should be treated for smut, and the formaldehyde (formalin) treatment has given the best results. Formaldehyde is a very active substance, and if not used carefully, it may damage the seed, often preventing germination. All cases of this kind, investigated by the Station, indicate that the directions were not followed carefully, and usually too much formaldehyde was used. It is not a difficult treatment if the directions are followed carefully.



Equipment for Formaldehyde (Formalin) Treatment of Seed Wheat

Formaldehyde (formalin) is a liquid and can be bought at most drug stores in pint bottles. One pint is sufficient to mix with 40 gallons of water in preparing a wheat-treating mixture. Smaller quantities may be prepared by mixing 3 tablespoons of formaldehyde (formalin) with

five gallons of water or two ordinary water buckets full. Either the springling or soaking method should prove efficient. The sprinkling method requires less liquid and can be done more conveniently on most farms. By the sprinkling method, the wheat is piled on the barn floor or some other convenient place. The solution is placed in a sprinkling can or bucket and as small quantities of the wheat are pulled out with a hoe or shovel, it is sprinkled and mixed so as to thoroughly wet each grain. After all of the wheat has been thoroughly wet, it is placed in a pile and covered with bags that have been wet in the solution, and then rinsed out. The wheat is allowed to remain piled in this way for two hours. It should then be spread out as thinly as possible and dried, unless it can be drilled or sown immediately. If the seed are thoroughly dried after this treatment, it will keep as long as dry wheat that has not been treated. It is usually best not to leave this treatment off until the day before planting, for wet wheat does not feed well through a drill. It may be done any time after harvest, but in summer the weather will be more favorable for drying. The formaldehyde treatment is not difficult to handle and will give good results if directions are followed carefully. Its use will save many times its cost by preventing smut.

PLANT EARLY

In most parts of the Piedmont and Mountain sections of the State wheat is very frequently planted too late for best results. In order to test this out, at the Piedmont Branch Station, near Statesville, the Division of Agronomy has made plantings at intervals of two weeks, beginning September 15 and ending December 15. At this farm the best results were secure from plantings made October 1-15. In this particular section most of the wheat is planted after November 1.

TABLE I.—Date of Seeding Wheat, Piedmont Branch Station, Statesville, N. C., 1913-1919.

Year	October 1-14		October 15-31		November 1-14		November 15-30		December 1-14	
	Yield Grain, Bu. Per Acre	Yield Straw, Lbs. Per Acre	Yield Grain, Bu. Per Acre	Yield Straw, Lbs. Per Acre	Yield Grain, Bu. Per Acre	Yield Straw, Lbs. Per Acre	Yield Grain, Bu. Per Acre	Yield Straw, Lbs. Per Acre	Yield Grain, Bu. Per Acre	Yield Straw, Lbs. Per Acre
1913	31.30	3320	27.00	2620	23.60	2160	22.60	1740	21.60	1600
1914	------	------	23.60	3080	20.60	3260	18.90	2165	11.60	1500
1915	13.17	1130	13.35	1060	------	------	12.00	1060	------	------
1916	19.57	1866	23.92	2155	21.13	1582	15.70	1498	15.67	1550
1917	------	------	8.75	635	10.58	975	8.33	560	5.92	635
1918	15.06	2120	17.30	2000	16.60	2240	16.00	1780	6.50	700
1919	23.70	2060	23.50	2180	20.30	2320	16.60	1700	7.70	1080
Averages	20.56	2099.20	19.63	1961.43	18.80	2102.83	15.73	1500.43	11.50	1177.50

The wheat growers of the Piedmont Section who plant wheat after November 1st are losing from two to ten bushels of wheat per acre.

During the past seven years seeding between October 1 and 14 have averaged 1.7 bushels per acre more than seeding between November 1

and 14. Seedings made between November 15 and 30 produced nearly 5 bushels less than those planted between October 1 and 15, and seedings made as late as December 1 to 15 yielded only about half as much as those made between October 1 and 14. A large portion of the wheat of the Piedmont and Mountain sections is planted from ten days to two weeks late for the best results.

COMMUNITY WHEAT IMPROVEMENT

The improvement of wheat should be a community problem. A large portion of the wheat of a community is threshed by a custom thresher. Individuals of the community find it difficult to keep their wheat pure when several varieties are being threshed in the community. Smut and weed seed may be carried from one farm to the other by a thresher that is not properly cleaned. For these reasons there should be community coöperation in the development of one good variety of wheat to the community. Test out the varieties grown in the community along with the strains bred by the Experiment Station and good seed from other sources. In this way it will not be difficult to choose one good variety. It will pay to get the best seed and keep it pure and productive by saving good seed each year. It would not be difficult to select enough good seed by hand to plant a seed patch each year. The seed patch could be planted on good ground that is free from onions and other weeds so that good seed could be saved on the farm each year. Seed saved in this way becomes better adapted to the locality, furnishing a larger yield and wheat of better quality.

The Division of Agronomy, West Raleigh, N. C., will help you start Community Wheat Improvement Work.

ORIGIN OF STRAINS Nos. 12 AND 32 OF LEAP'S PROLIFIC

In order that the Experiment Station and Piedmont Branch Station farms might be a source of good seed wheat for North Carolina growers, the Division of Agronomy started work on the improvement of Leap's Prolific wheat seven years ago. More than two thousand heads were selected from the best plants in the general crop wheat of the two farms. In order to have a large number of plants represented, only one head was taken from a plant. Each head was shelled out separately by hand and those having poorly formed seed were discarded. Twenty seed from each of the best heads were saved in a separate package and given a number. At planting time the seed saved from each head were planted in two short rows, one seed being planted to the hill, with six inches between hills each way. This gave the offspring of each plant an equal chance, and made it possible to compare their character of growth and other qualities. During the growing period, the rows were examined for vigor of growth and resistance to cold. In the spring at harvest

time all of the rows that had missing hills were discarded. Only t
plats that had a perfect stand were saved for seed. Each row was ha

Planting the Seed from Select Wheat Plants in Separate Rows

vested separately and the seed were kept separately. When the yield
and other comparisons were made, the seed from fifty rows were foun

Harvesting the Rows Separately to Compare the Yield and Quality Produced by Each Selection

good enough for a second trial. In the following year these fifty selec
tions were planted in larger plats to compare their yield and qualit

a second time. When these plats were harvested and the yields compared, eight of the best strains were saved separately for further testing. Seed from each of these strains were planted in rod rows and repeated fifty times in order to get a careful comparison of their yields and quality of grain. When these were harvested two of the strains yielded better than the others.

TABLE II.—Yield from Selected Strain of Leap's Prolific Wheat at Piedmont Branch Station—1918.

Rank	Strain Number	Yield, Bushels Per Acre
1	32	19.9
2	36	19.2
3	51	18.8
3	38	18.8
4	1	18.7
5	46	18.4
6	30	18.0
7	33	17.5
7	Pedigreed Leap's Prolific.	17.5
8	35	16.4
9	64	16.3

The selections ranged in yield between 16.3 and 19.9 bushels per acre. The best strain, No. 32, yielded 2.4 bushels per acre more than the best strain of pedigreed Leap's Prolific wheat that could be secured on the market. Strain No. 32 was also compared with good commercial seed wheat of the same variety. In this latter comparison the selected seed produced 4.6 bushels per acre more than the unselected seed.

SELECTED LEAP'S PROLIFIC WHEAT No. 32 COMPARED WITH COMMERCIAL SEED WHEAT, 1917

	Bus. per Acre
Selected Leap's Prolific No. 32	25.25
Commercial Seed Wheat, Leap's Prolific	20.65
Difference	4.60

Shall we doubt the value of saving good seed when select seed yield four and six-tenths bushels per acre more than unselected seed? What would this increase mean on your farm or in your community? In all of the tests, Leap's Prolific, Nos. 12 and 32, have yielded more than the Fulcaster wheat grown on the Piedmont Branch Station farm.

HOW CAN I GET SEED OF PEDIGREED STRAINS Nos. 12 AND 32 OF LEAP'S PROLIFIC?

From the large number of heads of wheat selected in 1913, the seed of two, Nos. 12 and 32, have won out in the contest of seven years. This work has required a large amount of time and the keeping of careful

records. The Branch Station farms will only be able to furnish a ve
small portion of the seed wheat needed in the State. For this reason t
is important that the few hundred bushels available this spring shall
placed in the hands of growers who are prepared and are willing
keep it pure and furnish seed wheat to other growers next spring. T
seed will be cleaned and will be free from smut and weed seed. T
Division of Agronomy is planning to sell this wheat at a reasonal
price to growers who are prepared to keep it pure. If there is a whe
growing community in the State that would like to test either of t
strains along with the varieties grown in the community, the Divisi
will furnish sufficient seed to make the test in small plats and will c
operate in the work. For such work, application should be ma
through the county agent, by at least ten growers of the communi
Applications should be made early so that arrangements can be ma
for the work. Apply to the Division of Agronomy, West Raleigh, N. C
for further information.